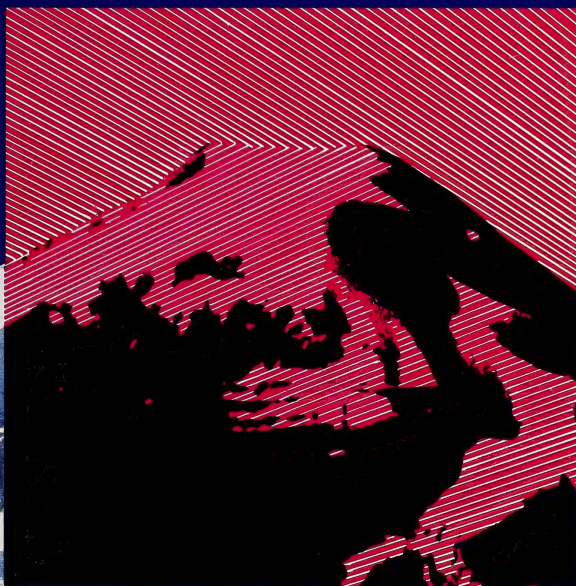


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A **R** **esearch & Development**
Network
The Alberta Commitment

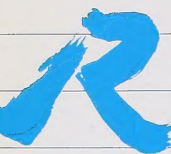


SDN 5432936



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Resources, Opportunity, Commitment:

Within the geographic boundaries that encircle almost half a million square kilometers, the province of Alberta blends mountain peaks with rolling hills, dense timberland and open prairie. It has a vast inventory of natural resources including the world's largest deposit of recoverable oil sands in the north, and rich, fertile agricultural land in the south.



This diversity in landscape and resources has been a force behind Alberta's movement into the global forum of advancing technology. It is the same diversity that presents Alberta's research and development community with both challenge and opportunity.

The challenge lies with integrating the province's multidimensional scientific, industrial and technological pursuits. The opportunity lies with the realization that Alberta is ripe with ambition, and rich in creative human resources.

This combination of initiative and innovation forms the cornerstone of Alberta's commitment to research and development to benefit not only the province, but also to open the way for national and international technological contribution. The Alberta research network represents

the unified commitment of industry, educators, scientists and government to place Alberta at the leading edge of research and development, here and abroad.

The financial investment in basic, applied and developmental research has been substantial. In the past five years, more than \$500 million have been channelled annually by all sectors and agencies into research and development programs in Alberta. This represents approximately 11 per cent of expenditures on such programs in Canada.



The Alberta Scene

With the first major oil strike almost 40 years ago, the potential of Alberta's energy reserves were confirmed. In nature's underground vaults, Alberta holds rich deposits in natural gas, conventional crude oil ... heavy oil ... recoverable oil sands ... and coal.

Agriculture is Alberta's second largest industry, behind energy related activities. Traditionally a strong contributor to the economic base, Alberta farmers account for about 20 per cent of Canada's agricultural output. Added to these resources is a flourishing timber industry and a large supply of hydro-energy.

With its population of 2.3 million, Alberta houses a highly educated work force, many of whom are dedicated to the province's research

and development ventures. Backed by numerous financial alternatives, and state-of-the-art equipment and facilities, Alberta scientists, engineers and researchers continue to gain international acclaim.

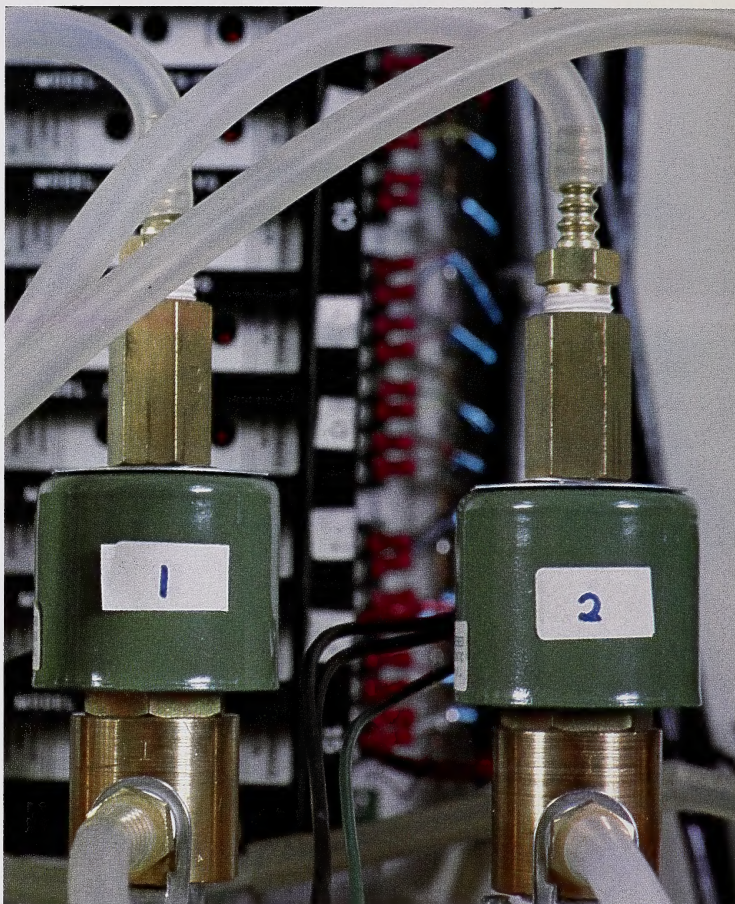
Fostering research and development is a prime mandate of Alberta's industrialists, educators and government. Cooperation is their approach. Together, they are aggressively searching for new technologies to economically and efficiently harness Alberta's raw resources and expand the province's industrial base through manufacturing and refinement of resource-based products. Technological advancements are adapted to the particular climatic and geographic situations in Alberta. The economic wealth of its natural resources is being translated by the Alberta research network into new vistas, new avenues of research and development.

The Alberta Government — Partner and Participant

While the government initiates programs and projects through its own agencies and departments, it has traditionally served in the role of a cooperative partner with members of the business and academic communities through funding and grants, joint participation and technology transfers.

On a per-capita basis, the Alberta government spends approximately three times more on research and development than any of its provincial counterparts in Canada. In 1984, the government allocated a total \$222.2 million to research and development, making it the largest single funding source in Alberta. Of this, \$192 million was budgeted directly for engineering, medicine and natural sciences.

While the government is actively involved in a broad spectrum of research and development enterprises at various departmental levels, three key agencies shoulder the responsibility of bolstering Alberta's technological thrust.



The Alberta Research Council

Formed in 1921, the Alberta Research Council is the oldest and largest provincial research organization in Canada, demonstrating the province's long-standing commitment to fostering Canadian research and development initiatives. The Research Council was created to identify Alberta's natural resources and explore methods for developing them. Today, it channels almost all of its \$40-million budget into research and development through its six major programs: natural resources, oil sands, coal, industrial and engineering research, advanced technologies, and applied sciences.

The Alberta Oil Sands Technology and Research Authority

Now in its tenth operating year, the Authority is an excellent example of the government's catalytic role in the realm of research and development. Its mandate is to provide the private sector and research organizations with financial incentives to develop economically viable and environmentally acceptable petroleum technology for oil sands, heavy oil and enhanced conventional oil recovery. Financial support will total some \$400 million by the end of 1985 and recipients include industry, universities, and other Canadian and international research interests.



The Alberta Heritage Foundation for Medical Research

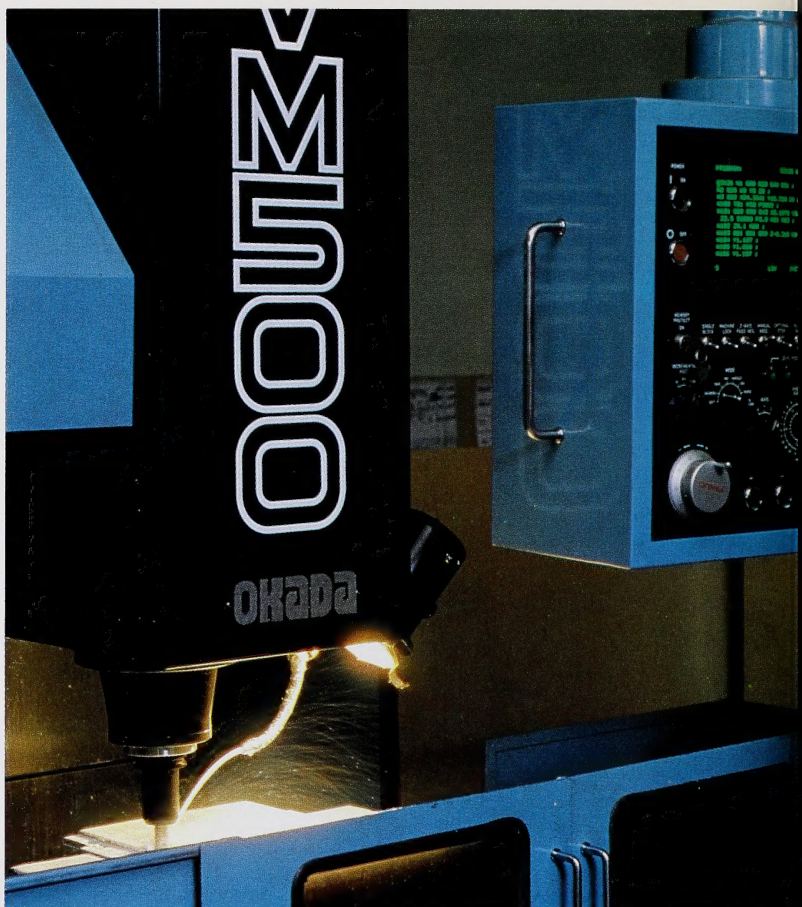
The most recent of the provincial government's research initiatives was established in 1979. Drawing from the interest of a \$300-million endowment from the Alberta Heritage Savings Trust Fund, this agency has contributed more than \$67 million directly to the scientific community to support research efforts in basic medical and clinical sciences. Through its awards and grants program, the Foundation is striving to establish a balanced long-term program of Alberta-based medical research, built on the strength of scientists working through the medical and academic facilities in the province.

A

lberta's Energy Challenge

One of the most pressing challenges facing Alberta scientists and engineers is the development and application of technology to help the resource industry deal with climatic extremes and widely varying geographic conditions. Alberta established the Centre for Frontier Engineering Research at the University of Alberta in 1983 to solve engineering problems particular to cold-climate energy development. The Alberta government contributed \$1.8 million to the \$6.4 million total project cost.

This challenge has also opened exciting avenues for diverse industrial interests to interconnect within the Alberta research and development network. As solutions are found for the challenging Alberta environment, they have technological applications world-wide.



Energy's Link to Electric Power

The physical isolation of most of Alberta's energy-related activities has long presented industry with unique challenges. One is the growing need for self-sufficient power sources in remote, unattended locations.

Global Thermoelectric Power Systems Ltd. is one of the companies in the province exploring alternate power sources. Global researchers have developed a remote power system which burns gaseous fuels, converting them directly to electric power. This system will, for instance, operate telecommunication repeaters at remote drilling sites with up to one kilowatt of power.

Global is one of only two manufacturers in the world producing thermoelectric generators. They

Diverse research interests work together within an Alberta research network, forging innovative partnerships and new avenues of technological advancements. As Canada's "energy province", the application of high technology to the challenges of the resource field is earning world-wide acclaim for Alberta's research community.

have developed several promising applications of the system including a portable vehicle engine heater; a larger five-kilowatt generator; a portable one-kilowatt manpack power source; and the concept of a thermoelectric power generator for use in hazardous areas where there is a real threat of explosion from ignitable gases and vapors.



Airborne Technology: Energy's Partner in the Skies

Alberta's energy industry is constantly seeking new ways to overcome cold weather conditions and ice accumulation which can hamper the efforts of exploration and drilling crews for several months of the year.

One technological approach has come in the form of a system for generating images mounted on small aircraft. Synthetic Aperture Radar, adapted by INTERA Technologies Ltd. for commercial use has found wide application in advising Arctic drilling and navigation projects of ice movement in northern waters. INTERA, is currently developing a Multi-Task Ice Data-Analysis System, in a joint research project with the Alberta Research Council which will allow data received by the radar system to be



Global Thermoelectric Power Systems Ltd. is just one of the Alberta companies working to find answers for problems in the province's energy field. As one of only two manufacturers of thermoelectric generators in the world, Global is providing self-sufficient power sources for remote, isolated drilling fields.

Another Alberta first ... the commercial application of an innovative air-borne radar mapping system, developed by INTERA Technologies Ltd. Designed to assist engineers working in far northern energy and navigational projects, this system exemplifies research custom-made for the Alberta climate, but with far-reaching international potential.



processed in real time images. This capacity will project the movement of ice, rather than just locate it.

Another significant advancement in aerial research and development is the integration of infra-red laser systems with inertial systems. A front-runner in navigational high technology, Nortech Surveys (Canada) Ltd., supervises extensive applied research and development programs with applications for resource-based industries, including energy and forestry. In addition to laser profiling, Nortech (through a two-year joint research agreement with the Alberta Research Council), is currently developing a computer-based navigational system linked to satellite rather than ground signals, permitting the use of less expensive fixed-wing aircraft instead of helicopters.

The Seismic Industry: High Technology in the Energy Field

With one-seventh of the world's seismic industry based in Alberta, it is not surprising that significant contributions in geophysical and instrumentation research are emanating from the province's public and private sectors. Nor is it surprising that this is the largest high technology industry in Alberta.

Research and development in advanced seismic technology is currently being carried out by a number of groups in the province — by petroleum companies such as Canterra Energy Ltd. and Shell Canada Ltd.; by university engineers and scientists; by surveying consultants like EDO Canada Ltd. and Nortech Surveys Canada; and by leading Canadian seismic experts including Teknica Resources Development Ltd., Digitech Ltd., Sefel Research Corporation, and Veritas Resources Services Ltd. In fact, Teknica is an established firm that has pioneered the use of computer imaging techniques for geophysical interpretation, and these latter three companies are currently earning Alberta an international reputation for excellence in related seismic technology.

Digitex Ltd. serves as an excellent model to demonstrate the successful marriage of high technology and geophysical data, and the reason why Alberta is applauded for its work in advanced seismic technology. A wholly Canadian-owned public company, Digitech has been a leading



contender in advanced digital processing of seismic data. One of its current projects is the transfer of Digitech software into interactive graphic work stations, allowing exploration geologists and geophysicists in the field more direct involvement in processing, and greater access to larger amounts of data. Prototypes of this data-based digital processing system are already in use and represent one of many innovations revolutionizing the seismic industry in Alberta.

Sefel Geophysical Ltd., the largest Canadian seismic contracting firm and fifth largest in the world, is undertaking extensive research and development through the Sefel Research Corporation. Working with an annual budget of up to \$8 million, the company's research arm is a proven leader in the development of

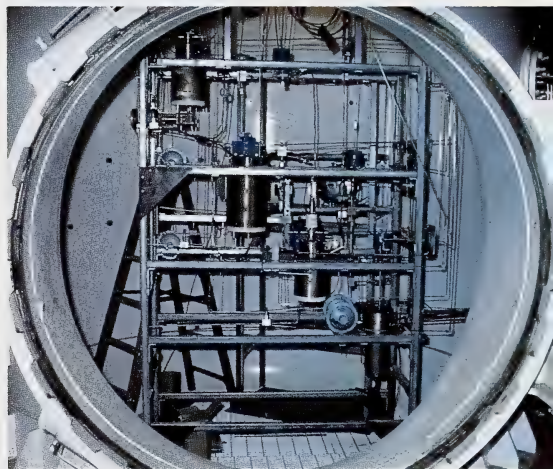
automatic statics and refraction techniques, as well as innovative data processing systems for land and marine seismic operations. In 1984, Sefel installed super-array computer hardware at its research centre that will be central to a new development program aimed at three-dimensional navigation and seismic systems.

In collaboration with United States universities, Veritas Resources Services Ltd. has addressed its research efforts to solving seismic processing problems particular to Western Canadian exploration. Working to develop new seismic data interpretation aids, Veritas is currently researching a type of deconvolution and multiple elimination processing systems, adapted for use in the Alberta energy fields but with far-reaching impact on international energy technology.



This red hot coil is the bench unit for the study of flash hydropyrolysis of coal. Pyrolysis is the partial liquefaction of coal which leaves a char of sufficient quality to use in power generating plants.

A large explosion containment cell encloses apparatus used in research on liquefaction of various Alberta coals.



Alberta Coal: A New Research Priority

In addition to its vast petroleum resources, Alberta has 87 per cent of Canada's coal reserves. The potential of coal has long been realized in the province, but it has only been in recent years that research and development programs related to this resource have been accelerating. The results of this aggressive thrust by industry, educators and government are helping pave the way for Canadian energy self-sufficiency.

In January, 1985, plans for a coal liquefaction pilot plant to be built near Edmonton by a private corporation were announced. The existing technology used in the liquefaction process, applying extremes of heat and pressure to raw coal to turn it into synthetic crude oil, is already being adapted to Alberta coals by Alberta Research Council scientists.

Many other research studies pertaining to coal mining are underway, exploring coal quality, petrography, environmental impact, gasification, and transportation. In addition to the Alberta Research Council's efforts, numerous corporations and agencies are working to develop coal-related technology through research. These include Esso Resources Canada Ltd, Crowsnest Resources, The Alberta Office of Coal Research and Technology, the University of Alberta Mineral Engineering Department, and Canada's CANMET Coal Research Laboratory and the Coal Mining Research Centre.

Whether producer or user, research efforts by these and other groups within the Alberta research and development network will ultimately change the face of the coal industry in Canada and the world.

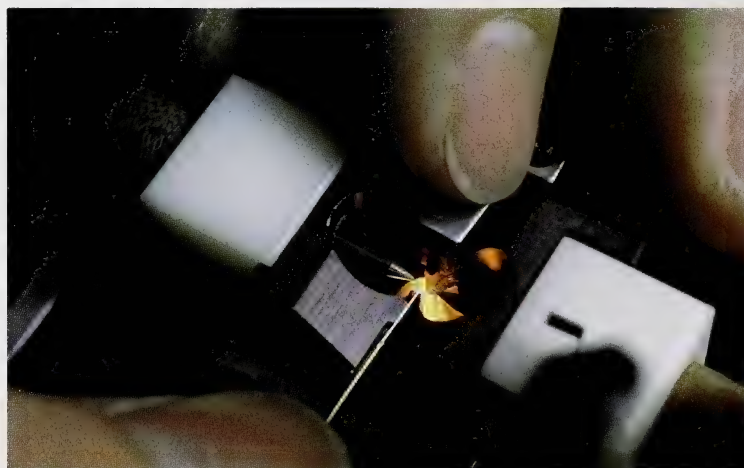
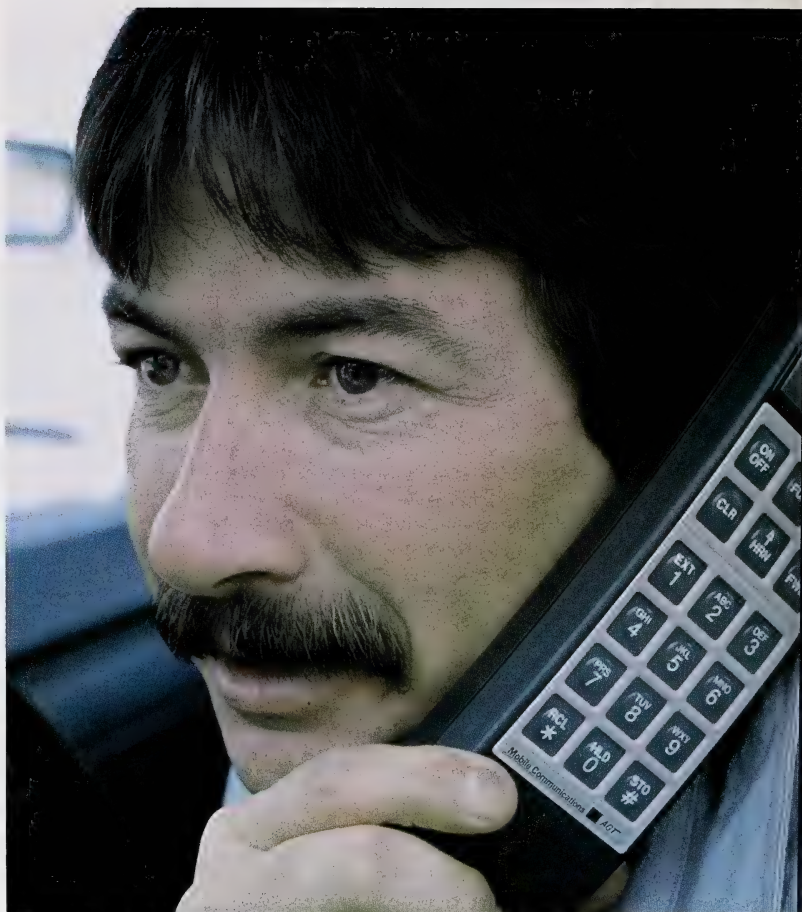
The Alberta Perspective on Electronic Technology

In recent years, Alberta's electronics industry has gathered momentum and importance in the province's research and development activities.

Through a massive infrastructure of private and public interests connecting provincial, national and multi-national resources, millions of dollars and thousands of research hours are spent annually in Alberta to develop and commercialize electronic technology. To assist electronic manufacturers, the Alberta Electronics Test Centre was recently established. This Centre undertakes tests on various products to assist Albertan, Canadian and non-Canadian manufacturers to obtain national and international product certifications. Operational now, the new test centre will eventually become part of the new \$62-million Alberta Research Council complex opening June 1985. The breakthroughs have been many, the technological applications diverse, and the developmental potential still not fully realized.

The province's network of research interests is examining the feasibility of applying electronics technology in medicine, instrumentation, energy, agriculture and education. The specialized systems borne from their pioneer work hold a bright promise for tomorrow.

Alberta's outstanding contributions to telecommunication technology include new advances in fibre optic research and North America's first cellular system — the AURORA mobile phone.





Telecommunications: State of the Art

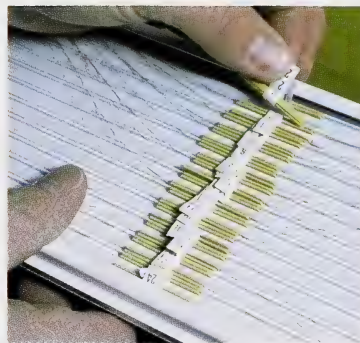
Working within Alberta, Canadian industries are tapping the resources available through corporations, the government, universities, and to further develop existing and potential applications of telecommunication electronic components.

This scientific exploration has led to many innovative developments, among them Canadian leadership in fibre optic research and advanced cellular telecommunications systems.

Bell-Northern Research Ltd., Canada's largest industrial research and development organization, has extensive laboratory facilities in Alberta. Owned by Northern Telecom Limited and Bell Canada, Bell Northern placed a major emphasis on fibre optic research and related

transmission product development, to be manufactured through Northern Telecom's Alberta-based plant. The extent of their research touches such areas as high-capacity fibre optics transmission for long-haul voice telecommunication; fibre optics transmission between metropolitan offices and fibre optic installation equipment.

In 1983, AURORA went into commercial operation in Alberta, becoming the first cellular phone system in North America and the first decentralized system in the world. Developed by NovAtel Communications Ltd., which is jointly owned by NOVA, AN ALBERTA CORPORATION and Alberta Government Telephones, the AURORA telecommunications system links microprocessor capabilities with a state-of-the-art computer-based con-



Linking distant urban centres ... or inter-office communications. \$250 million is allocated annually in Alberta on research and development that will ultimately generate new products for the electronics industry here and abroad.

trol, making it one of the most sophisticated mobile phone systems in the world today. By eliminating the need for costly "central switch" equipment, AURORA guarantees its mobile phone users uninterrupted conversations by doing away with the need to go through mobile operators.

With the acquisition of the CYBER 205, the University of Calgary entered the world of the supercomputers and opened new doors for the Alberta research network.

Myrias Research Corporation ... the birth of the world's fastest and most powerful supercomputer took place in Alberta.

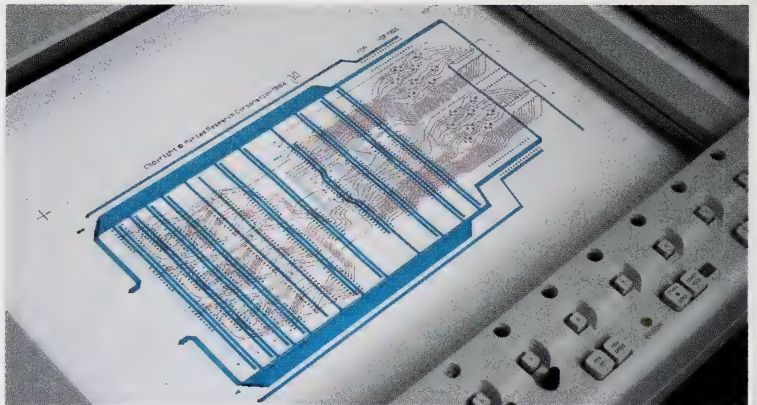
Supercomputers: A New Age

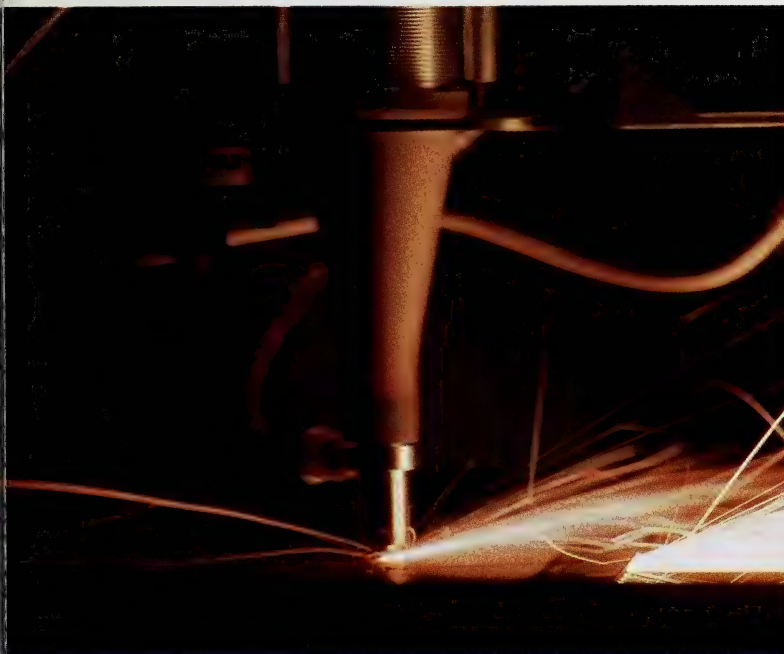
The computing capabilities available to existing and emerging high-tech industries and related research programs is reaching new peaks as Alberta enters the dawning age of supercomputers.

Myrias Research Corporation, a young Alberta company, has designed and is building what is currently the fastest and most powerful supercomputer in the world. Using fast parallel processing and a high-level software approach, the computer is immune to time losses from hardware breakdowns. The Myrias supercomputer is ideal for various complex, high volume applications.

Alberta universities continue to demonstrate their importance in the provincial research and development network with their accumulation of computer capabilities and expansion of computer-related programs.

In 1985, the University of Calgary acquired Canada's third supercomputer to provide a province-wide resource for post-secondary institutions and emerging high-tech industries. The installation of the CYBER 205 was made possible through cooperation between Control Data Canada Ltd., the University and the Alberta government.





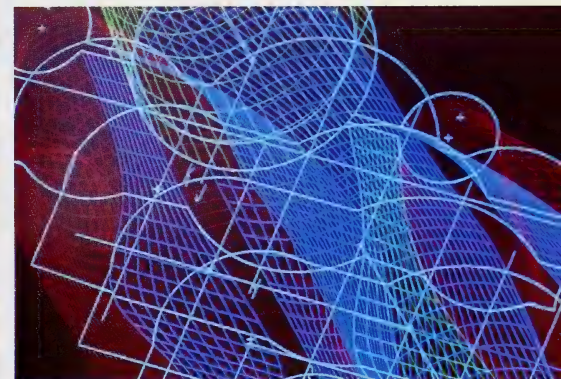
Capable of 400 million calculations per second, the supercomputer's potential to the Alberta research network is emphasized by the fact that more than 10 million hours have been booked for research and development by private and public interests.

As well, the University of Alberta in Edmonton is responsible for much of the advanced work in microelectronics. In addition to research carried out by various facilities and departments, it owns the Alberta Microelectronics Centre, a non-profit corporation established to transfer related technology between Alberta industry and the university. Access to the Centre provides a link to developments in areas such as real-time software, semi-custom integrated circuits, robotics and CAD/CAM.

The Centre is not alone in its interest in CAD/CAM. Laser applications of the system have brought General Systems Research Ltd. world attention. In 1983, General Systems began a \$6-million research and development program with funding assistance from the Alberta government. Using computer-programmed patterns, the LaserCAM 400 provides high-speed precision cutting of textiles and thin fibre materials. The most advanced technological development in computer applications in this field, General's laser cutting system has caught the attention of the North American automotive industry and several international interests and is now being produced in Alberta for export.

At Edmonton's Microelectronics Centre, educators, industry and government access new developments and innovations of the computer world.

From 400 million calculations per second to computerized patterns and precision laser fabric cutting ... Alberta's involvement in electronics research and development is rapidly putting the province at the leading edge of world technology and finding new potential in the international marketplace.



B iotechnology — **Alberta Enters New Medical Domains**

A strong Alberta commitment to medical research at both basic and applied levels is ensuring three aspects essential to any research and development program. It is drawing top medical researchers to the province, winning international accolades for the scientific community, and fostering far-reaching contributions to modern medicine.

Biotechnology is a basic tool to medical research, and central to both clinical and scientific medical programs. It is one of many research and development fields enhanced in Alberta by the integrated efforts of universities, private corporations, major hospitals and government funding agencies like the Alberta Heritage Foundation for Medical Research and the Medical Research Council of Canada.



Chemical Production for Medicine

The manufacturing of blood purifiers is an important support industry for the medical profession in their attempts to lessen the chances of reaction to organ and blood marrow transplants. Chembiomed Ltd., a University of Alberta-owned company formed in 1977, has developed the technology to chemically produce blood purifiers and manufacture blood-typing reagents using cloned cells from mice. Chembiomed researchers are now expanding their findings into polysaccharides, a synthetic complex sugar, with the intent to produce commercial products useful in the treatment of arthritis.

Nuclear Magnetic Resonance Technology for Cancer Research

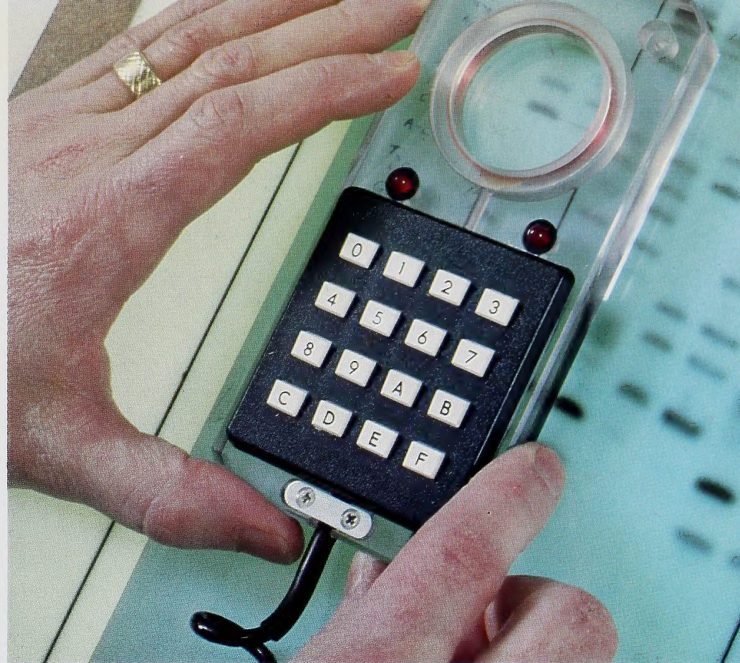
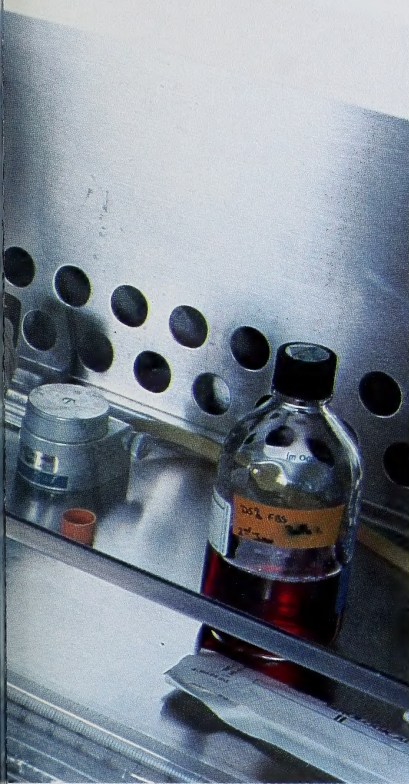
The Nuclear Magnetic Resonance research program is one of the largest projects funded by the Alberta Heritage Savings Trust Fund Cancer Research Program, which channels more than \$3.5 million into cancer research in Alberta each year.

Nuclear magnetic resonance spectrometers now are being used as diagnostic tools for displaying internal soft tissue using radio waves. As one of the few spectrometers in the world capable of monitoring the biochemical activity of the human body, its developers are researching its application to intact red blood cells and other cellular systems in the treatment of cancer.

Millions of dollars and thousands of research hours are spent annually in Alberta on medical research as the province translates the accumulated wealth from its energy resources into research programs that will benefit the quality of life for all. From the development of NMR spectrometers to the production of blood reagents, Alberta's medical research is already demonstrating an impact on modern medicine.

Genetic engineering research in Alberta is spawning a new pharmaceutical production industry through technological development and application.

Continuing in its role as a world leader in embryo transfer, Alberta Livestock Transplants is only one of many enterprises in the province aggressively pursuing genetic research.



Genetic Engineering Welcomes Biotechnological Application

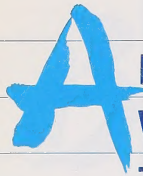
BIOLOGICALS inc., in a \$2-million joint effort with the Alberta Research Council, is applying a new genetic engineering computer program to assist in splicing together DNA molecules from different sources to generate recombinant DNA. The end result of this research program will be the production of related pharmaceuticals and specialty chemicals in Alberta.

The greatest concentration of genetic engineering and biotechnology research in Canada is taking place at the University of Calgary Faculty of Medicine with companies such as Alberta Livestock Transplants. The first in the world to specialize in embryo transfer, Alberta Livestock Transplants has maintained a research and development leadership

role for over 15 years. With obvious ramifications for livestock production, the company is currently involved in a research program to genetically produce identical twins through embryo freezing and micro-manipulation.

The Alberta Research Council is starting to expand the manufacturing base in Alberta for genetically engineered products with its \$3-million fermentation pilot plant that makes full use of computerized process control technologies. The project will allow biotechnical companies to move from the research phase into the production of proteins, including extraction and purification, opening new doors for Alberta's pharmaceutical industry.

These are examples of the partnerships and projects underway in the Alberta medical research arena. The commitment is strong and the expertise promises a future of new medical technology and products.



Alberta's Vision of Tomorrow

The research and development community in Alberta is a consortium of individuals and interests, unified in their commitment to secure a promising tomorrow for the province and its people. Collectively, they know the value of research and development in a world that is rapidly changing. They have the foresight to seek out new advancements that will have a lasting place in Alberta's industrial base. They have the expertise and capabilities to propel Alberta into national and international forums of technological research and development.

The partners and participants in the research network are many. First there are the industries. The scope of their involvement in research and technological development is evident in the ever-broadening industrial base of Alberta. Research and development touch the province's diversified natural resources ... petroleum, including oil and gas, heavy oil, and recoverable oil sands ... coal ... agriculture ... mining ... forestry. From this has grown a flourishing research base to support related industries such as petrochemical, seismic, food processing, forest products, telecommunications, computer processing and medical technology. With industry contributing 47 per cent of the research activity in Alberta, its role within the network is extremely significant.

Of equal impact are the contributions of Alberta's academic and scientific communities. As well, the Alberta government motivates research and development through financial support and participates in technological advancement as a partner. Every year more than \$210 million is funnelled into ongoing programs in Alberta ... by institutions, corporations, private and public agencies. All are a part of the Alberta commitment to a productive and creative integration of science, industry and technology.

For more information on research and development programs in Alberta, and the companies and agencies involved, or for assistance in reaching these private or public groups, please contact any of the Alberta government offices listed on the facing page.

For more information contact:

Office of Science and Technology
Alberta Research Council
7th Floor, 4445 Calgary Trail South
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